

Eutrophication of streams and rivers: dissolved nutrient-chlorophyll relationships for benthic algae

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Abstract. Statistical models for predicting the effects on algal biomass of eutrophication are much better developed for lentic systems than for lotic systems, partly because of the dynamic physical nature of streams as controlled by flood regimes. I analyzed data from 30 sites in 25 runoff-fed streams and rivers to develop statistical models for mean monthly and maximum chlorophyll *a* as a function of soluble nutrient concentrations and days of accrual (reflecting the frequency of flood disturbance events). Variation in stream-water nutrients explained 12–22.6% of the variation in mean monthly chlorophyll *a* and 29.5–32.5% of the variation in maximum chlorophyll *a* among sites. Days of accrual explained 39.7% and 61.8 % of the variation in mean monthly and maximum chlorophyll *a*, respectively. Multiple regression models combining dissolved nutrient data and days of accrual explained 43.7–48.8% of the variation in mean monthly chlorophyll *a* and 72.1–74.1% of the variation in maximum chlorophyll *a* among sites. In streams with infrequent floods and long accrual periods (e.g., 100 d), a relatively small increase in dissolved nutrients greatly increased the frequency of high biomass events. However, as could be anticipated, this result did not occur in more flood-prone streams. A nomograph to predict oligo-, meso-, and eutrophic conditions as a function of nutrient concentrations and days of accrual is presented based on the regression models for maximum chlorophyll *a*. The models need further testing, but might be useful for predicting the effects of changes in nutrients on benthic algal biomass in other temperate streams and rivers. I suggest that variable nutrient criteria for the prevention of benthic algal proliferations could be set in streams in relation to regimes of local flood frequency and expected time available for biomass accrual. The present analysis suggests that managing nutrient supply could not only reduce the magnitude of maximum biomass, but also reduce the frequency and duration of benthic algal proliferations in streams.

Key words: stream ecology, eutrophication, enrichment, nutrients, nitrogen, phosphorus, flooding, disturbance, algae, periphyton, water resources management

